

Enclosure 1

Sample Administrative Technical Specifications - Steam Generators with Alloy 600 MA Tubing

5.5.9 Steam Generator Program

- a. A Steam Generator Program shall be established and implemented to ensure that steam generator tube integrity is maintained. Steam generator tube integrity is maintained by meeting the following tube integrity performance criteria:
1. Structural Integrity Performance Criteria: Steam generator tubing shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby and cooldown and all anticipated transients included in the design specification). This includes retaining a margin of 3.0 against **burst** under normal steady state full power operation and a margin of 1.4 against burst under the limiting design basis accident or combination of accidents as is required by the existing design and licensing basis. *Note: revised words pertaining to the 1.4 factor may be necessary.*

Burst is defined as gross structural failure of the tube wall. The condition typically corresponds to an unstable opening displacement (e.g., opening area increased in response to constant pressure) accompanied by ductile (plastic) tearing of the tube material at the ends of the degradation.
 2. Accident Leakage Integrity Performance Criteria: The primary-to-secondary accident induced leakage rate for the limiting design basis accident, other than a steam generator tube rupture, shall not exceed *[the leakage rate assumed in the accident analyses in terms of total leakage rate for all steam generators and leakage rate for an individual steam generator]*. Leakage is not to exceed *[1 gpm per steam generator]*.
 3. Operational Leakage Integrity Performance Criteria: The RCS operational primary-to-secondary leakage rate through any one steam generator shall not exceed 150 gallons per day (gpd).

- b. **Condition monitoring assessments** shall be conducted during each outage during which the steam generators tubes are inspected, plugged, or repaired to confirm that the structural integrity and accident leakage performance criteria are being met.

Condition monitoring assessment means an evaluation of the “**as found**” condition of the tubing with respect to the structural integrity and accident leakage performance criteria. The “**as found**” condition refers to the condition of the tubing during a steam generator tube inspection outage, as determined from inservice inspection results or by other means, prior to the plugging or repair of tubes.

- c. Steam Generator Inspection Intervals: Steam generator tube inspection intervals shall be established and implemented to ensure that the steam generator tube integrity is

maintained. In addition, the inspection interval for each steam generator shall not exceed one fuel cycle or 24 EFPM, whichever is less.

- d. **Tube Repair Criteria** (i.e., tube plugging limits): Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding [40%] of the nominal tube wall thickness shall be plugged [or repaired] prior to plant restart (entry into Mode 4). *[The following tube repair criteria may be applied as an alternative to the 40% depth-based limit:*

Alternate tube repair criteria currently permitted by plant technical specifications are to be listed here. The description of these alternate tube repair criteria should be equivalent to the descriptions in current technical specifications.]

Tube repair criteria mean the acceptance criteria in terms of allowable flaw [depth] to be applied to the results of inservice inspection of the tubing.

- [e. **Tube repair methods:** Tubes found by inservice inspection to contain flaws not meeting the tube repair criteria may be repaired prior to plant restart in lieu of being plugged. Repair methods shall be as follows:

Tube repair methods currently permitted by plant technical specifications are to be listed here. The description of these tube repair methods should be equivalent to the descriptions in current technical specifications.]

Tube repair methods refer to methods for restoring the integrity of flawed sections of tubing such that the tube is acceptable for continued service without plugging. Plugging of tubes does not constitute a tube repair method.]

Sample Administrative Technical Specifications
- Steam Generators with Alloy 600 TT Tubing

5.5.9 Steam Generator Program

- a. A Steam Generator Program shall be established and implemented to ensure that steam generator tube integrity is maintained. Steam generator tube integrity is maintained by meeting the following tube integrity performance criteria:
1. Structural Integrity Performance Criteria: Steam generator tubing shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby and cooldown and all anticipated transients included in the design specification). This includes retaining a margin of 3.0 against **burst** under normal steady state full power operation and a margin of 1.4 against burst under the limiting design basis accident or combination of accidents as is required by the existing design and licensing basis. *Note: revised words pertaining to the 1.4 factor may be necessary.*

Burst is defined as gross structural failure of the tube wall. The condition typically corresponds to an unstable opening displacement (e.g., opening area increased in response to constant pressure) accompanied by ductile (plastic) tearing of the tube material at the ends of the degradation.
 2. Accident Leakage Integrity Performance Criteria: The primary-to-secondary accident induced leakage rate for the limiting design basis accident, other than a steam generator tube rupture, shall not exceed *[the leakage rate assumed in the accident analyses in terms of total leakage rate for all steam generators and leakage rate for an individual steam generator]*. Leakage is not to exceed *[1 gpm per steam generator]*.
 3. Operational Leakage Integrity Performance Criteria: The RCS operational primary-to-secondary leakage rate through any one steam generator shall not exceed 150 gallons per day (gpd).
- b. **Condition monitoring assessments** shall be conducted during each outage during which the steam generators tubes are inspected, plugged, or repaired to confirm that the structural integrity and accident leakage performance criteria are being met.
- Condition monitoring assessment** means an evaluation of the “**as found**” condition of the tubing with respect to the structural integrity and accident leakage performance criteria. The “**as found**” condition refers to the condition of the tubing during a steam generator tube inspection outage, as determined from inservice inspection results or by other means, prior to the plugging or repair of tubes.
- c. Steam Generator Inspection Intervals: Steam generator tube inspection intervals shall be established and implemented to ensure that the steam generator tube integrity is maintained. In addition, the inspection interval for each steam generator shall be limited as follows:

1. Except as provided for in 2., inspect 100% of tubes at sequential intervals of 120, 90, and, thereafter, 60 EFPM. The first sequential interval shall be considered to begin at the first inservice inspection of the steam generators. In addition, inspect 50% of the tubes by the refueling outage nearest the mid point of the interval and the remaining 50% by the refueling outage near the end of the interval. No steam generator can operate for more than two fuel cycles or 48 EFPM, whichever is less, without being inspected.
2. If any steam generator contains a degradation mechanism(s) exceeding the **degradation activity threshold** during a given inspection, the next inspection interval for each steam generator for the subject degradation mechanism(s) shall not exceed one fuel cycle or 24 EFPM, whichever is less.

Degradation activity threshold refers to any of the following:

1. A combination of ten or more new indications ($\geq 20\%$ of the initial tube wall thickness) of thinning, pitting, wear, impingement, or other form of volumetric indications which display an average growth rate equal to or greater than 25% of the tube repair limit in one inspection-to-inspection interval. Damage from loose parts or foreign objects may be excluded from consideration only if the causal objects are identified and removed from the steam generators.
 2. One or more new or previously identified indications ($\geq 20\%$ of the initial tube wall thickness) which display a growth increment greater than or equal to the **tube repair criteria** in one inspection-to-inspection interval. Damage from loose parts or foreign objects may be excluded from consideration only if the causal objects are identified and removed from the steam generators.
 3. Any crack indication (e.g., outside diameter intergranular attack/stress corrosion cracking or inside diameter stress corrosion cracking).
- d. **Tube Repair Criteria** (i.e., tube plugging limits): Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding *[40%]* of the nominal tube wall thickness shall be plugged prior to plant restart (entry into Mode 4).

Tube repair criteria mean the acceptance criteria in terms of allowable flaw depth to be applied to the results of inservice inspection of the tubing.

Sample Administrative Technical Specifications
- Steam Generators with Alloy 690 TT Tubing

5.5.9 Steam Generator Program

- a. A Steam Generator Program shall be established and implemented to ensure that steam generator tube integrity is maintained. Steam generator tube integrity is maintained by meeting the following tube integrity performance criteria:
1. Structural Integrity Performance Criteria: Steam generator tubing shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby and cooldown and all anticipated transients included in the design specification). This includes retaining a margin of 3.0 against **burst** under normal steady state full power operation and a margin of 1.4 against burst under the limiting design basis accident or combination of accidents as is required by the existing design and licensing basis. *Note: revised words pertaining to the 1.4 factor may be necessary.*

Burst is defined as gross structural failure of the tube wall. The condition typically corresponds to an unstable opening displacement (e.g., opening area increased in response to constant pressure) accompanied by ductile (plastic) tearing of the tube material at the ends of the degradation.
 2. Accident Leakage Integrity Performance Criteria: The primary-to-secondary accident induced leakage rate for the limiting design basis accident, other than a steam generator tube rupture, shall not exceed *[the leakage rate assumed in the accident analyses in terms of total leakage rate for all steam generators and leakage rate for an individual steam generator]*. Leakage is not to exceed *[1 gpm per steam generator]*.
 3. Operational Leakage Integrity Performance Criteria: The RCS operational primary-to-secondary leakage rate through any one steam generator shall not exceed 150 gallons per day (gpd).
- b. **Condition monitoring assessments** shall be conducted during each outage during which the steam generators tubes are inspected, plugged, or repaired to confirm that the structural integrity and accident leakage performance criteria are being met.
- Condition monitoring assessment** means an evaluation of the “**as found**” condition of the tubing with respect to the structural integrity and accident leakage performance criteria. The “**as found**” condition refers to the condition of the tubing during a steam generator tube inspection outage, as determined from inservice inspection results or by other means, prior to the plugging or repair of tubes.
- c. Steam Generator Inspection Intervals: Steam generator tube inspection intervals shall be established and implemented to ensure that the steam generator tube integrity is maintained. In addition, the inspection interval for each steam generator shall be limited as follows:

1. Except as provided in 2., inspect 100% of tubes at sequential intervals of 144, 108, 72, and, thereafter, 60 EFPM. The first sequential interval shall be considered to begin at the first inservice inspection of the steam generators. In addition, inspect 50% of the tubes by the refueling outage nearest the mid point of the interval and the remaining 50% by the refueling outage near the end of the interval. No steam generator can operate for more than three fuel cycles or 72 EFPM, whichever is less, without being inspected.
2. If any steam generator contains a degradation mechanism(s) exceeding the **degradation activity threshold** during a given inspection, the inspection interval for each steam generator for the subject degradation mechanism(s) shall not exceed one fuel cycle or 24 EFPM.

Degradation activity threshold refers to any of the following:

1. A combination of ten or more new indications ($\geq 20\%$ of the initial tube wall thickness) of thinning, pitting, wear, impingement, or other form of volumetric indications which display an average growth rate equal to or greater than 25% of the tube repair limit in one inspection-to-inspection interval. Damage from loose parts or foreign objects may be excluded from consideration only if the causal objects are identified and removed from the steam generators.
2. One or more new or previously identified indications ($\geq 20\%$ of the initial tube wall thickness) which display a growth increment greater than or equal to the **tube repair criteria** in one inspection-to-inspection interval. Damage from loose parts or foreign objects may be excluded from consideration only if the causal objects are identified and removed from the steam generators.
3. Any crack indication (e.g., outside diameter intergranular attack/stress corrosion cracking or inside diameter stress corrosion cracking).
4. **Tube Repair Criteria** (i.e., tube plugging limits): Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding *[40%]* of the nominal tube wall thickness shall be plugged prior to plant restart (entry into Mode 4).

Tube repair criteria mean the acceptance criteria in terms of allowable flaw depth to be applied to the results of inservice inspection of the tubing.

Enclosure 4

Priority Guideline Issues

EPRI PWR SG Examination Guidelines, Revision 6, Section 5.2, "Degradation Assessment": Section 5.2 should be revised to include clarification similar to the following:

One key objective of degradation assessment is to identify not only currently active degradation mechanisms, but also potential degradation mechanisms which may occur over the lifetime of the steam generators. This is important to ensure that inspection techniques are employed during each inspection which are capable of detecting active and potential degradation mechanisms which may occur over the lifetime of the steam generators at all locations where such mechanisms may potentially occur. Assessment of potential degradation mechanisms should consider, but not be limited to, experience at plants of similar design and materials. Such assessments need also consider factors such as the susceptibility of the tubing material to stress corrosion cracking, operating temperature and pressures, residual stresses associated with tube bending or expansion processes during fabrication, and secondary side water chemistry including the potential for contaminants such as lead, chlorides, sulfates, and copper. It is particularly important for degradation assessments consider that many degradation mechanisms in the past have occurred due to deviation of conditions from nominal; e.g., off nominal material micro-structures or residual stresses due to process control deficiencies during fabrication, design shortcomings leading to fluid-elastic instabilities and fatigue, presence of loose parts and foreign objects.

The following clarification should be included at end of second to last paragraph of Section 5.2, "Degradation Assessment."

This assessment consider any recent experience from other facilities or study results which indicate a need for updating the degradation and operational assessment supporting the planned surveillance interval. For example, the occurrence of stress corrosion cracking at another plant employing similar tubing materials may potentially have implications for when cracks may be expected to first initiate at the subject unit.

EPRI Steam Generator Integrity Assessment Guidelines, Appendix M, "Discussion - Recommended Definition of Burst": Clarification is needed that wear flaws are not necessarily local. Wear flaws were the cause of two SG tube rupture events in the US. Perforations of the tube wall of sufficient size to cause leakage approaching tube rupture accident proportions constitute gross structural failure and, thus, burst. (See additional discussion in accompanying enclosure entitled "Review of Industry Responses to Staff Comments Concerning Prescriptive Steam Generator Inspection Intervals.")